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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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O. DAVIS, Kenneth, A. [/]; O. GARVEY, Charles, C.; O.

Published

(54) Title: METHOD AND APPARATUS FOR DISINFECTING A WATER COOLER RESERVOIR

(54) Titre: PROCEDE ET APPAREIL POUR LA DESINFECTION DU RESERVOIR D'UNE FONTAINE D'EAU REFRIGEREE

(57) Abstract

A method and apparatus for providing sanitized water in a bottled water dispenser uses a refrigeration system to cool the water and an ozone generating system to generate ozone for sanitizing the water. Ozone is generated and collected within an ozone generator housing. A blower transmits air to the housing, the air carrying the ozone through a flow line to an air diffuser that is positioned inside the reservoir of the water dispenser. A timer deactivates the refrigeration system and at about the same time activates the ozone generator and the blower. The blower continues to pump air for a selected time period after the ozone generator is shut down, the water in the reservoir having been sanitized. This action dispenses any ozone odor. The pump then shuts off and the refrigeration system resumes operation of cooling the water in the reservoir.

(57) Abrégé

Cette invention concerne un procédé et un appareil d'aseptisation de l'eau d'une fontaine de distribution d'eau en bouteille. Ledit appareil comprend un système de réfrigération pour réfrigérer l'eau et un système générateur d'ozone pour produire l'ozone nécessaire à l'aseptisation de l'eau. L'ozone est généré et recueilli à l'intérieur d'un boîtier de génération de l'ozone. Un ventilateur approvisionne le boîtier en air, le flux d'air transportant l'ozone par une conduite jusqu'à un diffuseur d'air situé à l'intérieur du réservoir de la fontaine à eau. Une minuterie désactive le système de réfrigération et, à peu près en même temps, active le générateur d'ozone et le ventilateur. Après désactivation du générateur d'ozone, le ventilateur continue à pomper de l'air pour une durée déterminée, l'eau du réservoir ayant été aseptisée. Cette opération ne dégage aucune odeur d'ozone. La pompe est alors désactivée et le système de réfrigération reprend son opération de réfrigération de l'eau du réservoir.

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(71) Applicant (for all designated States except US): INFINIT INDUSTRIES INC. (US/US); 101 Airline Drive, Metairie, LA 70001 (US).
(72) Inventor; and
(75) Inventor/Applicant (for US only): DAVIS, Kenneth, A. [US/US]; 4309 West Napoleon Avenue #316C, Metairie, LA 70001 (US).
(74) Agents: GARVEY, Charles, C. et al.; Three Lakeway Center, Suite 3290, 3838 North Causeway Boulevard, Metairie, LA 70002 (US).

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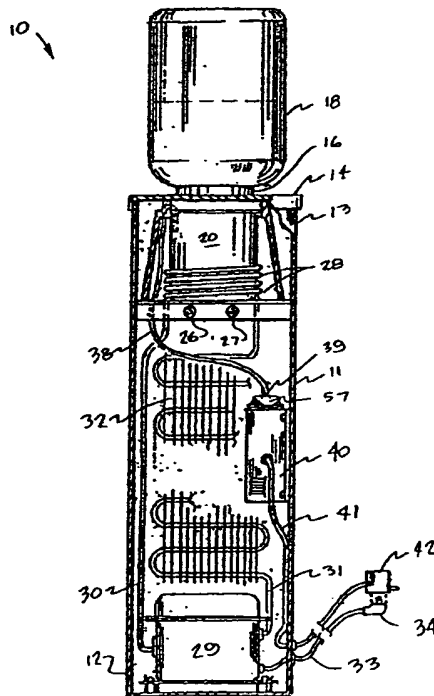
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(54) Title: METHOD AND APPARATUS FOR DISINFECTING A WATER COOLER RESERVOIR

(57) Abstract

A method and apparatus for providing sanitized water in a bottled water dispenser uses a refrigeration system to cool the water and an ozone generating system to generate ozone for sanitizing the water. Ozone is generated and collected within an ozone generator housing. A blower transmits air to the housing, the air carrying the ozone through a flow line to an air diffuser that is positioned inside the reservoir of the water dispenser. A timer deactivates the refrigeration system and at about the same time activates the ozone generator and the blower. The blower continues to pump air for a selected time period after the ozone generator is shut down, the water in the reservoir having been sanitized. This action dispenses any ozone odor. The pump then shuts off and the refrigeration system resumes operation of cooling the water in the reservoir.



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Description

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TITLE OF THE INVENTION

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"METHOD AND APPARATUS FOR DISINFECTING A WATER COOLER
RESERVOIR"

INVENTOR: DAVIS, Kenneth A., a U.S. citizen, of 4309 West Napoleon
Avenue, #316C, Metairie, LA 70001.

15

CROSS-REFERENCE TO RELATED APPLICATIONS

In the US, this is a continuation of US Patent Application
Serial No. 09/220,554, filed 23 December 1998.

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STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

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REFERENCE TO A "MICROFICHE APPENDIX"

Not applicable

15 BACKGROUND OF THE INVENTION

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1. Field of the Invention

The present invention relates to bottled water dispensers, and
more particularly to an improved bottled water dispenser for
dispensing water that has been sanitized using ozone and more
particularly to an improved method and apparatus for sanitizing a
water cooler of the type having an inverted bottle for containing
water with a neck portion of the bottle communicating with an open
reservoir.

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2. General Background of the Invention

One of the most common types of bottled water dispensers is
a floor standing cabinet having an open top that receives a large
inverted bottle. The bottle is typically of a plastic or glass
material having a constricted neck. The bottle is turned upside
down and placed on the top of the cabinet with the neck of the
bottle extending into a water filled reservoir so that the water
seeks its own level in the reservoir during use. As a user draws
water from a spigot dispenser, the liquid level in the reservoir
drops until it falls below the neck of the bottle at which time
water flows from the bottle and bubbles enter the bottle until
pressure has equalized.

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These types of inverted bottle water dispensers are sold by

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5 a number of companies in the United States. Many are refrigerated.

One of the problems with bottled water dispensers that use an inverted bottle is that of cleansing the unit from time to time. Because the top is not air tight, it breathes so that bacteria can
10 5 easily enter the reservoir over a period of time.

In addition to the problem of an open top, the five gallon bottles that are typically used in combination with a cabinet having an open reservoir are themselves a source of bacteria and germs. Most of these bottles are transported on trucks where the
15 10 bottles are exposed to outside air. They are handled by operators that typically grab the bottle at the neck, the very part of the bottle that communicates with the open reservoir during use. Unfortunately, it is difficult to convince every person that handles these bottles to wash their hands frequently enough.

15 In order to properly sanitize such a water dispenser or cooler, the user must carefully clean the neck of the bottle prior to combining the bottle with the cabinet. Further, the user should drain and sanitize the reservoir from time to time. The cleansing of the reservoir in such a water dispenser is a time consuming
20 25 project that is typically not done often enough.

30 The present invention provides an improved self sanitizing water dispenser apparatus as well as a method for generating ozone for cleaning the reservoir and the water contained within it.

35 25 BRIEF SUMMARY OF THE INVENTION

The present invention provides a self sanitizing bottled water dispenser that includes a cabinet having upper and lower end portions, the upper end portion of the cabinet having a cover with an opening for receiving and holding a bottle of water to be
40 30 dispensed.

The bottle contains water to be dispensed, and provides a neck portion and a dispensing outlet portion.

45 A reservoir contained within the cabinet next to the upper end portion thereof contained water with a water service that
35 50 communicates with a bottle neck during use. A refrigeration system cools the water within the reservoir. A diffuser ring emits

5 bubbles into the reservoir, the diffuser ring being disposed within
the reservoir at the lower end portion thereof and next to the
reservoir wall so that bubbles emitted by the diffuser ring helps
10 scrub the wall.

15 An ozone generator is supported within the housing. Air flow
lines communicate with an air pump to carry ozone from the ozone
generator housing to the diffuser ring. A blower generates air
flow and a flow line connects the blower to the ozone generator
housing.

20 A timer is provided for activating the ozone generator at a
selected time and for a selected time interval. The timer
initially deactivates the refrigeration system compressor while
simultaneously activating the air pump. The timer activates the
ozone generator after the air pump is activated.

25 The ozone generator is activated for a selected time interval
(e.g. a few minutes). After the selected time interval, the ozone
generator is shut off, but the air pump continues air flow for a
time period of a few minutes in order to help disperse any odor of
ozone. The air pump is then shut off and the refrigeration system
30 compressor starts operation again to cool the water.

The diffuser ring is preferably positioned around the side of
the reservoir at the bottom of the reservoir, close to the
intersection of the reservoir bottom wall and reservoir side wall.

35 The diffuser ring can be preferably circular in shape.

40 The reservoir preferably has a center portion and the diffuser
ring has openings positioned to direct air away from the center
portion of the reservoir.

45 The reservoir includes a generally vertical side wall and the
diffuser ring is positioned to discharge bubbles against the side
wall so that the side wall is scrubbed with ozone bubbles during
30 use.

50 The ozone generator housing is comprised of an upper housing
section, a lower housing section and a gasket positioned in between
the upper and lower sections. An ozone generator is contained
within the interior of the housing. Fittings on the housing enable
35 air to flow into and out of the housing. A blower generates air

5 flow to carry air into the ozone housing and from the ozone generator housing to the air diffuser. A HEPA filter at the air intake removes airborne microorganisms.

10 5 BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the nature, objects, and advantages of the present invention, reference should be made to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

Figure 1 is a sectional elevational view of the preferred embodiment of the apparatus of the present invention;

Figure 2 is a partial perspective exploded view of the preferred embodiment of the apparatus of the present invention illustrating the ozone generator portion thereof;

Figure 3 is a partial sectional elevational view of the preferred embodiment of the apparatus of the present invention illustrating the reservoir, bottle, and ozone diffuser portions thereof;

Figure 4 is a fragmentary view of the preferred embodiment of the apparatus of the present invention illustrating the open reservoir and ozone diffuser;

Figure 5 is a sectional view taken along lines 5-5 of Figure 4;

Figure 6 is a fragmentary elevational view illustrating the ozone diffuser and its position in relation to the reservoir.

40 DETAILED DESCRIPTION OF THE INVENTION

Figures 1-3 show generally the preferred embodiment of the apparatus of the present invention designated by the numeral 10 in Figure 1. Water dispenser 10 provides an improved apparatus that sanitizes the open reservoir from time to time with ozone. The apparatus 10 includes a cabinet 11 having a lower end portion 12 and an upper end portion 13. The upper end portion 13 carries a cover 14 having an opening 17.

The opening 17 provides an annular flange 15 and a gasket 16

5 that defines an interface with bottle 18. The bottle 18 is a
commercially available bottle that is typically of a several gallon
volume (e.g. five gallons) in the United States. The bottle 18
10 provides a constricted bottled neck 19 that is placed inside an
5 open reservoir 20 as shown in Figures 1 and 3 during use. The
bottle neck 19 has an opening for communicating with a reservoir
20 at the interior of the cabinet 11 that holds the water product
15 to be dispensed and consumed. When the reservoir 21 is lowered
during use, air bubbles enter the bottle and water replenishes the
10 reservoir 20 until pressure equalizes.

The reservoir 20 has an interior 21 surrounded by reservoir
20 sidewall 22 and reservoir bottom wall 23. The reservoir can be,
for example, generally cylindrically shaped and of a stainless
15 steel or plastic material. The reservoir 20 provides an open top
for communicating with the neck 19 of bottle 18.

25 During use, reservoir 20 has a water surface 25 that
fluctuates slightly as water is dispensed and then replenished by
bottle 18. One or more spigots 26, 27 can be provided for
withdrawing water contained in reservoir 20. In the embodiment
30 shown in Figure 3, for example, a left hand spigot 26 has a flow
line 35 that extends up to and near the surface 25 of water
contained in reservoir 20. The spigot 26 thus removes ambient
temperature water from reservoir 20 that is not in close proximity
35 to the cooling coils 28. The spigot 27 provides a port 36 for
25 communicating with water contained in reservoir 20. Because the
refrigeration coils 28 are positioned at the lower end of reservoir
20, the spigot 26 withdraws cool water. As a practical matter, a
40 water dispenser apparatus 10 could provide either ambient
temperature water, cold water or heated water if, for example, a
30 flow line 35 were to be provided with a heating element.

45 For cooling the water at the lower end portion of the
reservoir 20, a cooling system that includes a compressor 29 can
be provided. The refrigeration system includes flow lines 30, 31
in combination with compressor 29 to transmit cooling fluid to
35 coils 28 and then to heat exchanger 32 as part of a system for
cooling water in reservoir 20. Power to the apparatus 10 is
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5 provided by electrical lines, including an electrical line 33
provided with plug 34. The plug 34 can be fitted to controller 42
having receptacle 44 and plug 43 as shown in Figure 2. In this
10 fashion, electricity can be selectively routed to the compressor
5 29 via electrical line 33 or to the housing 40 containing ozone
generator 50 using electrical line 41. This feature enables the
compressor to be deactivated when the ozone generator 50 is to be
used to transmit ozone to reservoir 20 for cleaning water contained
15 in it and for scrubbing the inside walls of reservoir 20.

20 In Figure 1 and 2, the housing 40 includes an ozone generator
50 that generates ozone for cleaning water contained in reservoir
20. Additionally, the housing 40 contains a motor drive 53 and
20 blower 54 that move air through an ozone generator housing 57 to
diffuser 37. Air line 38 communicates between ozone generator
15 housing 57 and ozone diffuser 37. Fitting 39 provides a connection
for attaching the exit air flow line 38 to ozone generator 57 as
25 shown in Figure 1 and 2.

Housing 40 can be provided with flanges 45 and openings 46 for
enabling the housing 40 to be retrofitted to an existing cabinet
20 11 by bolting the housing 40 to the cabinet 11 as shown in Figure
30 1.

In Figure 2, housing 40 includes a lower end portion 47 and
an upper end portion 48. The upper end portion 48 provides an
opening 49 to which ozone generator housing 57 can be affixed. An
35 ozone generator 50 is contained within the housing 57 as shown in
25 Figure 2. Housing 57 includes a lower housing section 58 and an
upper housing section 59. Flange 60 of lower housing section 58
and flange 61 of upper housing section 59 each engage gasket 62
40 upon assembly.

30 Bolted connections 63 can be used for attaching the housing
57 to housing 40 at internally threaded openings 64 on housing 40
as shown in Figures 1 and 2. During use, the controller 42
45 normally deactivates the ozone generator 50 during normal hours
when the users are dispensing water from the apparatus 10. Because
35 the ozone used to disinfect reservoir 20 has a distinctive smell,
it is preferable to clean the water contained in reservoir 20, to
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5 clean the inside walls of reservoir 20 and the bottle neck 19, at
a selected time. The controller 42 could be activated for example
during early morning hours (e.g. 3:00 a.m. - 4:00 a.m.) and can be
10 a commercially available controller that activates transformer 51
5 and motor drive 53 only after compressor 29 and the refrigeration
system have been deactivated by the controller 42. This
accomplished by shutting off the flow of electricity to plug 34 and
electric line 33 that supply electricity to compressor 29.

15 After electricity is disconnected from compressor 29,
10 transformer 51 and motor drive 53 are activated. The transformer
51 produces electricity with a very high voltage at ozone generator
20 50 for generating ozone within the confines of ozone generator
housing 57. As this ozone is generated within housing 57, air is
pumped with air pump 54 into inlet flow line 55 and via opening 56
15 into the interior of housing 57. HEPA filter 71 removes airborne
microorganism before they can enter air pump 54 and flow line 55.
25 This positive flow of air pressure into housing 57 causes a
simultaneous discharge of air through fitting 39 into air flow line
38. The air flow line 38 then carries air to diffuser 37 that is
30 contained at the bottom at the side wall of reservoir 20. The
specific placement of diffuser 37 and the flow of air therefrom
containing ozone is shown more particularly in Figures 4-6. In
Figure 4, a top view of the reservoir shows that the diffuser 37
preferably extends 360 degrees about the periphery of reservoir 20
35 and at the sidewall 22 thereof. This is preferable because ozone
bubbles 67 are used to scrub the side wall 22 at the inside surface
as shown in Figure 3.

40 The diffuser 37 is supported by a plurality of feet 68 that
extend between the diffuser 37 and a bottom wall 23 of reservoir
30 20. Openings 69 in diffuser 37 are directed at an angle with
respect to the bottom wall 23 and side wall 22 of reservoir 20 as
shown in Figure 6. An angle 70 of preferably about 45 degrees
45 defines the orientation of openings 69 with respect to the walls
22, 23. This configuration of the openings 69 relative to the
35 walls 22, 23 ensures that bubbles 67 will be discharged outwardly
toward side wall 22, to maximize the scrubbing effect at the
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interior wall 22 of reservoir 20. This scrubbing action using ozone bubbles 67 cleans the sidewall 22 and produces a rolling flow of water within reservoir 20. The bubbles 67 will strike the surface 25 of the reservoir 20 and flow inwardly. Such a circulation ensures that all of the water within the reservoir 20 is cleaned. Further, directing the bubbles from diffuser 37 outwardly toward wall 22 ensures that none of the bubbles 67 will enter bottle 18 via neck 19 which would cause the device to overflow.

The following table lists the parts numbers and parts descriptions as used herein and in the drawings attached hereto.

PARTS LIST

	Part Number	Description
	10	water dispenser
15	11	cabinet
	12	lower end
25	13	upper end
	14	cover
	15	annular flange
20	16	gasket
30	17	opening
	18	bottle
	19	bottle neck
	20	reservoir
35	21	interior
25	22	reservoir side wall
	23	reservoir bottom wall
40	24	open top
	25	water surface
30	26	spigot
	27	spigot
45	28	refrigeration coil
	29	compressor
	30	flow line
35	31	flow line
50	32	heat exchanger

5		33	electrical line
		34	plug
		35	flow line
10		36	outlet port
	5	37	diffuser
		38	air line
		39	fitting
15		40	housing
		41	electrical line
	10	42	controller
		43	plug
20		44	receptacle
		45	flange
		46	opening
	15	47	lower end
25		48	upper end
		49	opening
		50	ozone generator
		51	transformer
30	20	52	electrical line
		53	motor
		54	blower
		55	air line
35		56	air inlet
	25	57	ozone generator housing
		58	lower housing section
		59	upper housing section
40		60	flange
		61	flange
	30	62	gasket
		63	bolted connection
45		64	internally threaded opening
		65	arrow
		66	arrow
	35	67	bubble
50		68	foot

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opening

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angle

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filter

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5 The foregoing embodiments are presented by way of example
only; the scope of the present invention is to be limited only by
the following claims.

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Claims

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CLAIMS

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1. A bottled water dispenser, comprising:
 - a) a cabinet having upper and lower end portions;
 - b) the upper end portion of the cabinet having a cover with an opening for receiving and holding a bottle of water to be dispensed;
 - c) a bottle containing water to be dispensed, said bottle having a neck portion and a dispensing outlet portion;
 - d) reservoir contained within the cabinet, the reservoir containing water with a water surface that communicates with the bottle neck during use;
 - e) a refrigeration system for cooling water within the reservoir;
 - f) a diffuser ring for emitting bubbles into the reservoir, said diffuser ring being disposed within the reservoir at the lower end portion thereof and next to the reservoir wall so that bubbles emitted by the diffuser ring help scrub the wall;
 - g) an ozone generator housing supported next to the housing, said housing having an ozone generator inside the housing and air flow lines for transmitting air to and from the housing interior;
 - h) a blower for generating air flow;
 - i) a first air flow line connecting the blower and the housing interior;
 - j) a second air flow line connecting the housing interior with the diffuser ring; and
 - k) a timer that activates the ozone generator at a selected time and for a selected time interval and then deactivates the ozone generator after the selected time interval expires, said timer activating said blower and said ozone generator at about the same time during said selected time interval, and which at about the same time deactivates the refrigeration system.

2. The bottled water dispenser of claim 1 wherein the diffuser ring is positioned around the side of the reservoir at the bottom of the reservoir.

5 1 3. The bottled water dispenser of claim 1 wherein the
2 2 diffuser ring is generally circular.

10 1 4. The bottled water dispenser of claim 1 wherein the
2 2 reservoir has a center portion and the diffuser ring has openings
3 3 positioned to direct air away from the center portion of the
4 4 reservoir.

15 1 5. The bottled water dispenser of claim 1 wherein the
2 2 reservoir includes a generally vertical sidewall and the diffuser
3 3 ring is positioned to discharge bubbles against the sidewall so
4 4 that the sidewall is scrubbed with ozone bubbles during use.

20 1 6. The bottled water dispenser of claim 1 wherein the ozone
2 2 generator housing is comprised of an upper housing section, a lower
3 3 housing section and a gasket positioned in between the upper and
25 4 lower housing sections.

30 1 7. The bottled water dispenser of claim 1 further comprising
2 2 means for enabling the blower to continue to generate air flow into
3 3 said ozone generator housing and air diffuser via said first and
4 4 second air flow lines for selected time after the ozone generator
5 5 has been deactivated.

35 1 8. The bottled water dispenser of claim 1 further comprising
2 2 a transformer for generating high voltage electricity for the ozone
3 3 generator.

40 1 9. The bottled water dispenser of claim 1 wherein the
2 2 diffuser ring is spaced horizontally away from the bottled neck
3 3 portion.

45 1 10. A bottled water dispenser, comprising:
2 2 a) a cabinet having upper and lower end portions;
3 3 b) the upper end portion of the cabinet having a cover with
50 4 an opening for receiving and holding a bottle of water to be

- 5 dispensed;
- 6 c) a bottle containing water to be dispensed, said bottle
- 7 having a neck portion and a dispensing outlet portion;
- 8 d) reservoir contained within the cabinet, the reservoir
- 9 containing water with a water surface that communicates with the
- 10 bottle neck during use;
- 11 e) a refrigeration system for cooling water within the
- 12 reservoir;
- 13 f) a diffuser ring for emitting bubbles into the reservoir,
- 14 said diffuser ring being disposed within the reservoir at the lower
- 15 end portion thereof and next to the reservoir wall so that bubbles
- 16 emitted by the diffuser ring help scrub the wall;
- 17 g) an ozone generator housing supported next to the housing,
- 18 said housing having an ozone generator inside the housing and air
- 19 flow lines for transmitting air to and from the housing interior;
- 20 h) a blower for generating air flow;
- 21 i) a first air flow line connecting the blower and the
- 22 housing interior;
- 23 j) a second air flow line connecting the housing interior
- 24 with the diffuser ring; and
- 25 k) a timer that activates the ozone generator at a selected
- 26 time and deactivates the ozone generator after a selected time
- 27 interval.

- 35 1 11. A bottled water dispenser, comprising:
- 2 a) a cabinet having upper and lower end portions;
- 3 b) the upper end portion of the cabinet having a cover with
- 4 an opening for receiving and holding a bottle of water to be
- 40 5 dispensed;
- 6 c) a bottle containing water to be dispensed, said bottle
- 7 having a neck portion and a dispensing outlet portion;
- 8 d) reservoir contained within the cabinet, the reservoir
- 45 9 containing water with a water surface that communicates with the
- 10 bottle neck during use;
- 11 e) a refrigeration system for cooling water within the
- 50 12 reservoir;

5 13 f) a diffuser ring for emitting bubbles into the reservoir,
14 said diffuser ring being disposed within the reservoir at the lower
15 end portion thereof and next to the reservoir wall so that bubbles
16 emitted by the diffuser ring help scrub the wall;

10 17 g) an ozone generator housing supported next to the housing,
18 said housing having an ozone generator inside the housing and air
19 flow lines for transmitting air to and from the housing interior;

15 20 h) a blower for generating air flow;

21 i) a first air flow line connecting the blower and the
22 housing interior;

23 j) a second air flow line connecting the housing interior
24 with the diffuser ring; and

20 25 k) a timer means for activating the ozone generator and at
26 about the same time for deactivating the refrigeration system.

25 1 12. A method of sanitizing a bottled water dispenser having
2 a cabinet with a refrigeration system that cools a reservoir, and
3 wherein an inverted water supply bottle replenishes the reservoir
4 as water is dispensed comprising the steps of:

30 5 a) using the refrigeration system to cool the water in the
6 reservoir;

7 b) generating ozone with an ozone generator;

8 c) collecting the generated ozone inside of an ozone
9 generator housing;

35 10 d) providing an ozone diffuser inside the reservoir;

11 e) transmitting ozone from the ozone generator housing to
12 the diffuser;

40 13 f) using a blower in step "e" to drive the ozone to the
14 reservoir;

15 g) deactivating the refrigeration system at some time
16 between steps "a" and "f";

45 17 h) deactivating the ozone generator and the blower after
18 water in the reservoir has been sanitized; and

19 i) using the blower to pump air to the reservoir after the
20 ozone generator has been deactivated in step "h".

5

1 13. The method of claim 12 further comprising the step of
2 spacing the diffuser from the bottle neck so that ozone from the
3 diffuser does not enter the bottle.

10

1 14. The method of claim 12 wherein the step "g" proceeds
2 steps "b" through "f".

15

1 15. The method of claim 12 wherein a controller
2 simultaneously activates the ozone generator and deactivates the
3 refrigeration system.

20

1 16. The method of claim 12 wherein the refrigeration system
2 is deactivated before the ozone generator is activated.

25

1 17. The method of claim 12 wherein the refrigeration system
2 is deactivated and the blower activated at about the same time.

30

1 18. The method of claim 12 further comprising the steps of
2 deactivating the blower and activating the refrigeration system
3 after step "i".

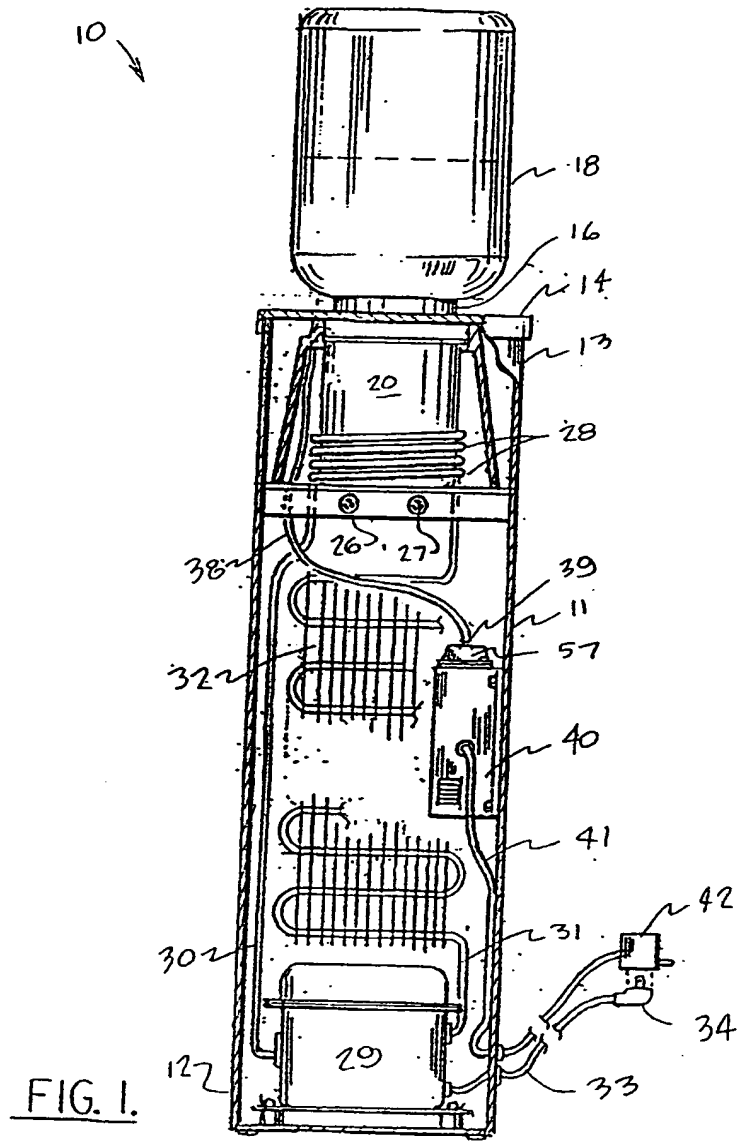
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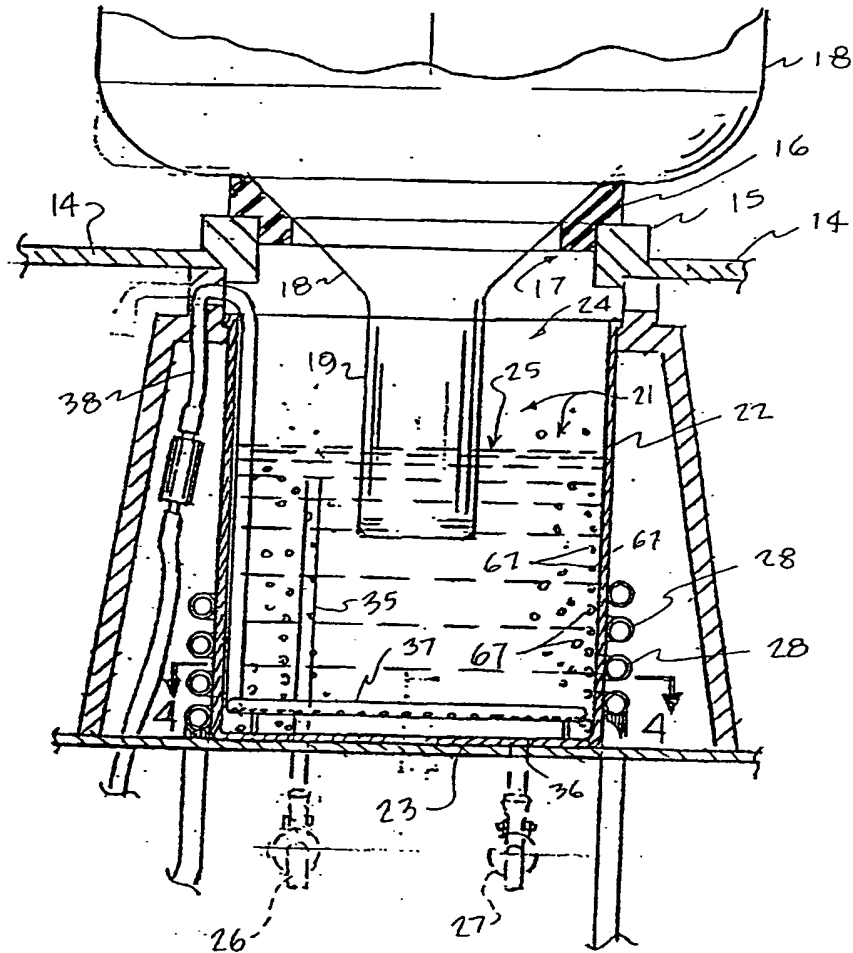
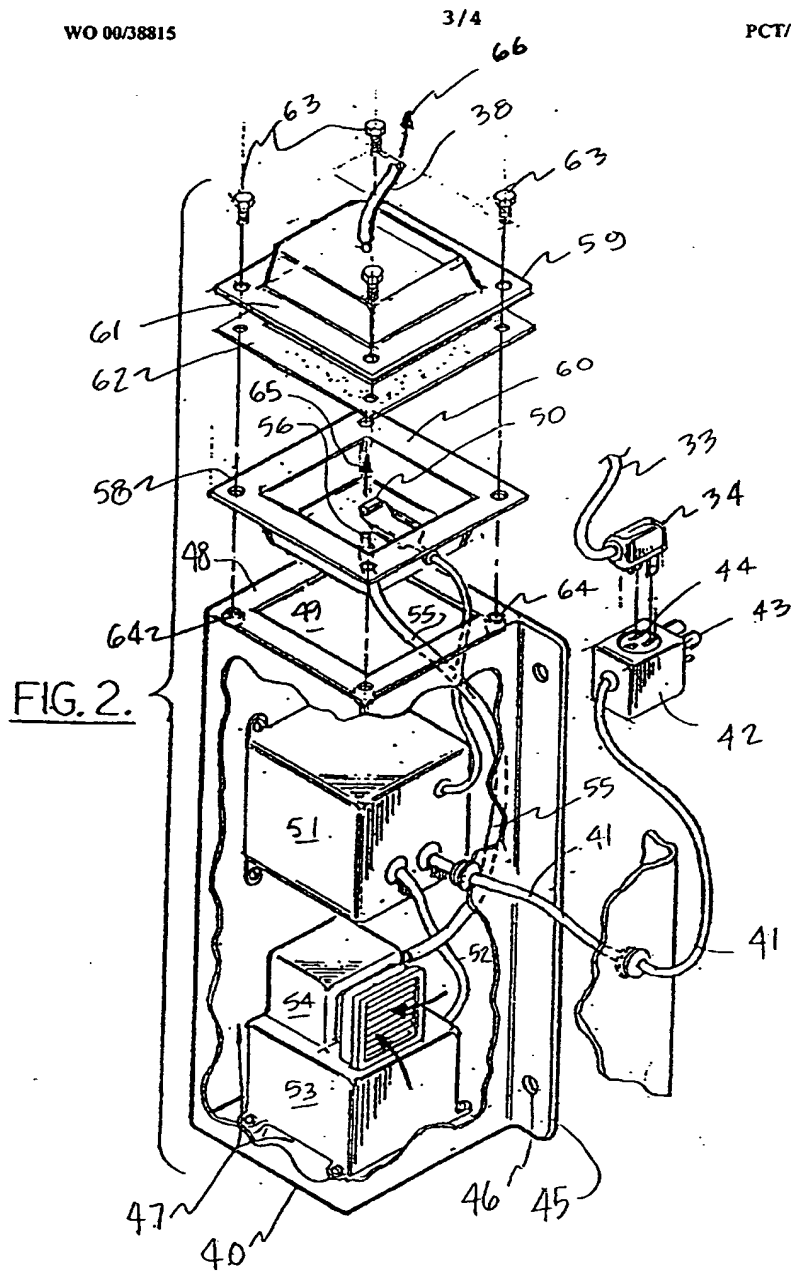


FIG. 3.



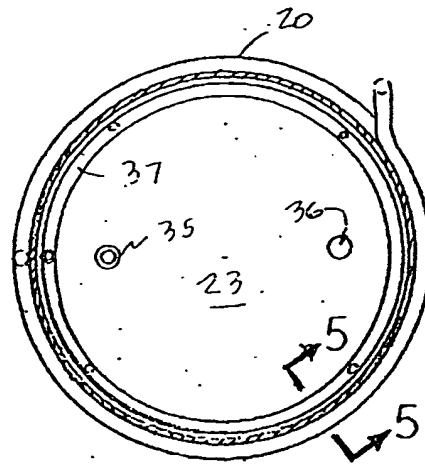


FIG. 4.

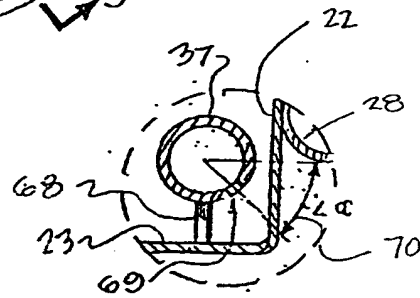


FIG. 6

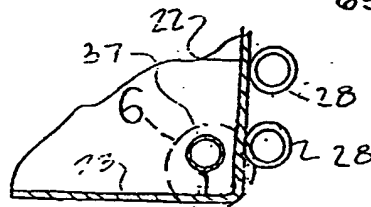


FIG. 5.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/27248

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : B01D 21/30 US CL : 62/389,392; 222/190 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 62/389,392; 222/190 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,366,619 A (MATSUI et al) 22 November 1994, See figure 1.	10
Y	US 5,015,394 A (McELLENNEY et al) 14 May 1991, See figure 1.	10
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "A" document member of the same patent family		
Date of the actual completion of the international search 23 MARCH 2000		Date of mailing of the international search report 19 MAY 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer MELVIN JONES Telephone No. (703) 305-0251

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